SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to The Editor of Science, Garrison-on-Hudson, N. Y.

THE PRODUCTION OF SCIENTIFIC KNOWLEDGE[1]

THE great value of scientific research both to the industries and to the nations at large is now generally recognized throughout the world and the last few years have seen a remarkable increase in the efforts made to stimulate the production of scientific knowledge. In 1914 the American Association for the Advancement of Science appointed a Committee of One Hundred to inquire into the steps which should be taken for the increase of scientific research in the United States and the work of this committee has been continued and expanded by the National Research Council. Among the European nations there is a great awakening to the national value of scientific research. The British government has appointed a Department of the Privy Council to deal with the subject, while it is announced that in France a new national laboratory on a very large scale has been projected. In Australia the government has appointed a special department to consider what steps should be taken for the organization and development of research work in the Commonwealth, and in Canada the matter has been the subject of government inquiry and solicitude.

The increase of scientific knowledge can be divided into three steps: first, the production of new knowledge by means of laboratory research; second, the publication of this knowledge in the form of papers and abstracts of papers; third, the digestion of the new knowledge and its absorp-

[1] Being a paper read before the Rochester Section of the Optical Society of America, October 23, 1917.

tion into the general mass of information by critical comparison with other experiments on the same or similar subjects. The whole process, in fact, may be likened to the process of thought. We have first the perception by means of the senses. The percept is then stored in the memory and in the mind is compared with other previously stored percepts, and finally forms with them a conception.

I desire in this paper to consider the methods by which these three sections of the production of knowledge may be carried on, to suggest an arrangement of laboratories to produce experimental results dealing with any branch of science, then to consider how the knowledge so obtained may best be stored and classified and finally the methods to be employed to make the results of scientific research available for application.

1. RESEARCH WORK

The agencies engaged in scientific research are of several kinds. The traditional home of research work is in the university, and the bulk of the scientific production of the world comes from institutions connected with teaching. The industries are more and more supporting research laboratories, a large number of which contribute to the general fund of scientific knowledge by publishing the results which they obtain, and some of which are engaged upon purely scientific work of no mean order. Consulting and technical laboratories engaged in industrial work make frequent contributions to science, and there are some very important laboratories engaged in pure research work which are supported by philanthropic foundations.

The classification of research laboratories is not altogether an easy task. They may obviously be classified according to the source of the funds which support them; that is, we may classify them as university laboratories, industrial laboratories, government laboratories, institution laboratories, and so on, but if we look at them simply in the light of the research undertaken, this does not seem to be altogether a logical classification since there is little distinction between the work done in some university laboratories and some industrial laboratories, and the work of the government and institution laboratories again overlaps that of the two former classes.

The University of Pittsburgh, for instance, has an industrial laboratory where definitely technical problems are dealt with. The research work on photometry done at Nela Park and at Cornell University would seem to be similar in kind, and work on physical chemistry or on the structure of chemical compounds is of the same type, requires the same class of workers, and produces the same results, whether it be done in a university, in a laboratory of the Carnegie Institution or in such an industrial laboratory as that of the General Electric Company. It is equally difficult to classify laboratories according to the purpose for which researches are avowedly carried on. Most university laboratories are willing to undertake work of industrial value, and, indeed, some specialize in such problems; while many industrial laboratories are quite willing to carry out a research of purely academic and theoretical interest provided the problems involved bear a relation to the general work of the laboratory.

A useful classification of laboratories can, however, be obtained if we consider whether the problems investigated in a laboratory are all connected with one common subject or whether the problems are of many kinds, having no connecting bond of interest. I would suggest that the first type of laboratory might be called "con-

vergent" laboratories and the second "divergent.'"

In the "divergent" group of laboratories are included all those institutions where research is carried on which are interested in science in general or in science as applied to industry and which will attack any problem which may seem to promise progress in knowledge or, in the case of an industrial laboratory, financial return. Most university laboratories are of this type. When they devote themselves to special problems it is usually because of the predilection of some professor, and as a general rule a student or instructor may choose any problem in the whole field of the science in which he is working and may carry out an investigation on that problem if he be interested in it without regard to the relation of his work to the other work which is carried on in the same laboratory.

Correspondingly, in most industrial laboratories the problems investigated are those which present themselves as a result of factory experience or of suggestions from the men working in the laboratory and which promise financial return, and the different problems carried on in the same laboratory are not necessarily related in any way whatever.

The greater number of university and industrial laboratories are necessarily of this type. It would be a disadvantage for a university laboratory, whose primary business is training students, to be too narrowly specialized. Specialized university laboratories are only desirable in the case of post-graduate students, and it would be very inadvisable to allow the laboratories responsible for the general training of scientific men to specialize in one branch of science, since as a result the students would acquire a proper acquaintance with only a limited portion of their subject.

Industrial laboratories, on the other hand, must necessarily be prepared to deal with any problems presented by the works, and as these will be of all kinds, covering generally the whole field of physics, chemistry and engineering, it is impossible for the usual works laboratory to specialize except in so far as it deals with the works processes themselves.

In the "convergent" laboratories, however, although the actual investigations may cover as great a range of science as those undertaken in a "divergent" laboratory, yet all those investigations are directed toward a common end; that is, towards the elucidation of associated problems related to one subject. Thus, the staff of the Geophysical Laboratory, which includes physicists, geologists, crystallographers, mineralogists and chemists, works on the structure of the rocks, and although the field of the actual investigations ranges from high temperature photometry to the physical chemistry of the phase rule, yet the results of all the work carried out are converged on the problem of the structure and the origin of the earth's crust.

The Nela Park Laboratory, in the same way, is studying the production, distribution and measurement of illumination, and all its work, which may involve physiology, physics and chemistry, is related to that one subject. Such convergent laboratories sometimes develop in universities owing to the intense interest of a professor in a single subject and to the enthusiasm which inspires students and assistants to collaborate with him and to concentrate all their energies on the same group of problems. There are many examples of such laboratories, such as the laboratories dealing with radio-activity, and those which are concerned chiefly with spectroscopy. Among others may be mentioned the Cavendish Laboratory at Cambridge and several of the larger university laboratories which deal with the physical chemistry of solutions.

But these university laboratories are rarely able to concentrate on to the group of problems which they are studying specialists from such different branches of science as are available for similar laboratories outside the universities owing to the fact that it is very difficult to obtain interdepartmental cooperation in research in a university. In a specialized laboratory, on the other hand, workers in all branches of

The purpose of this laboratory is the investigation of the scientific foundations of photography and its applications, everything relating to photography in all its branches and applications being of interest. The branches of science which are of chief importance in photographic problems are those of optics in physics and of the colloidal, physical and organic branches of chemistry, and the relations of these sci-

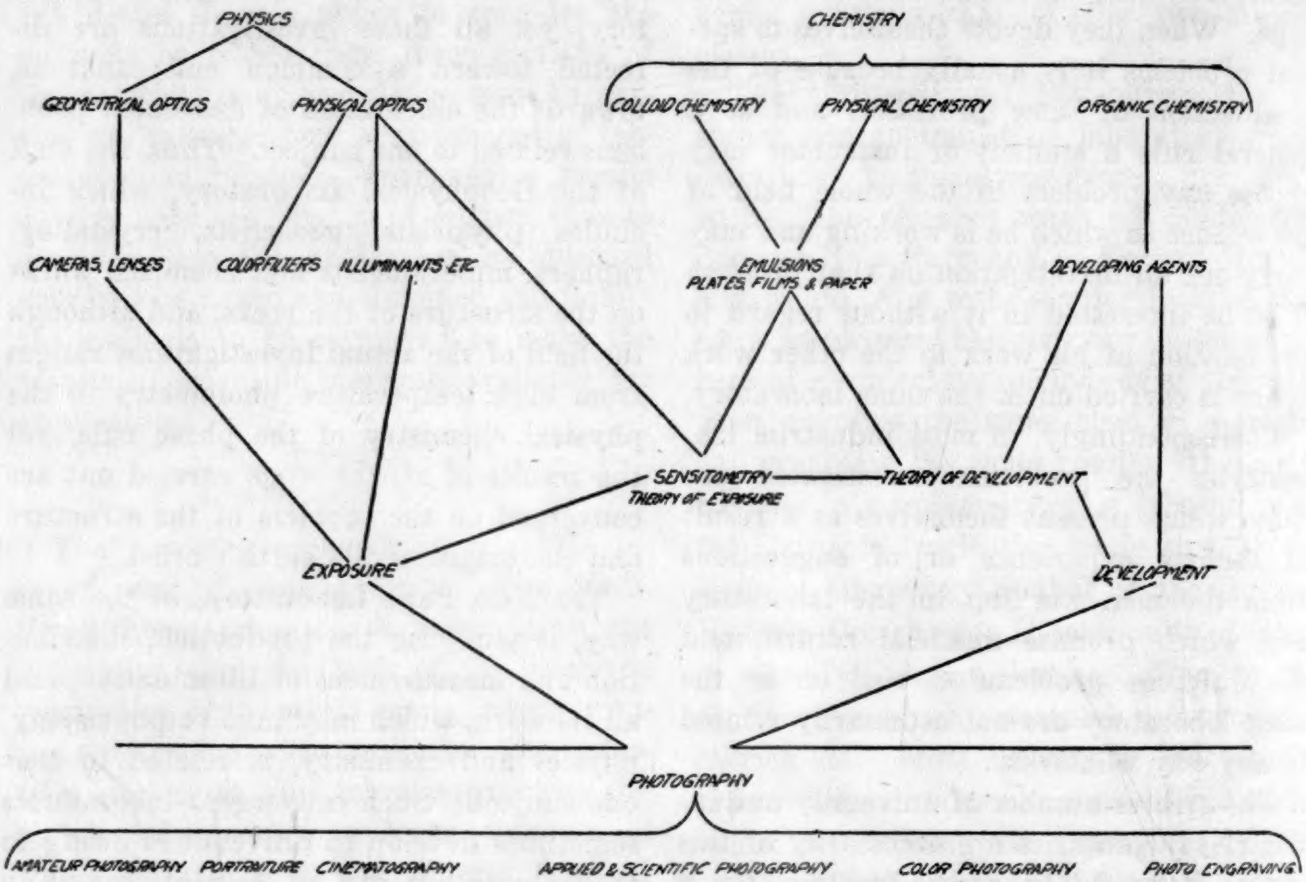

FIG. 1.

science may well collaborate in the investigation of problems representing different points of view of one general subject.

In addition to the examples of industrial and institutional laboratories mentioned above I should like to illustrate the structure of a convergent laboratory, if I may be forgiven for doing so. by referring to the organization of the research laboratory with which I am connected—that of the Eastman Kodak Company.

ences to photographic problems are shown in graphic form in Fig. 1.

Optics deals on its geometrical side with the materials used in photography—cameras, lenses, shutters, etc.—and on its physical side with such materials as color filters and illuminants, but especially with the study of the relation of the photographic image to the light by means of which it was produced—a study which is known by the name of sensitometry. The manufacture

of the sensitive material itself, which in the case of modern photographic plates, films and paper is called the emulsion, is a province of colloid and physical chemistry, colloid chemistry dealing with the precipitation and nature of the sensitive silver salts formed in their gelatine layer, while physical chemistry informs us as to the nature

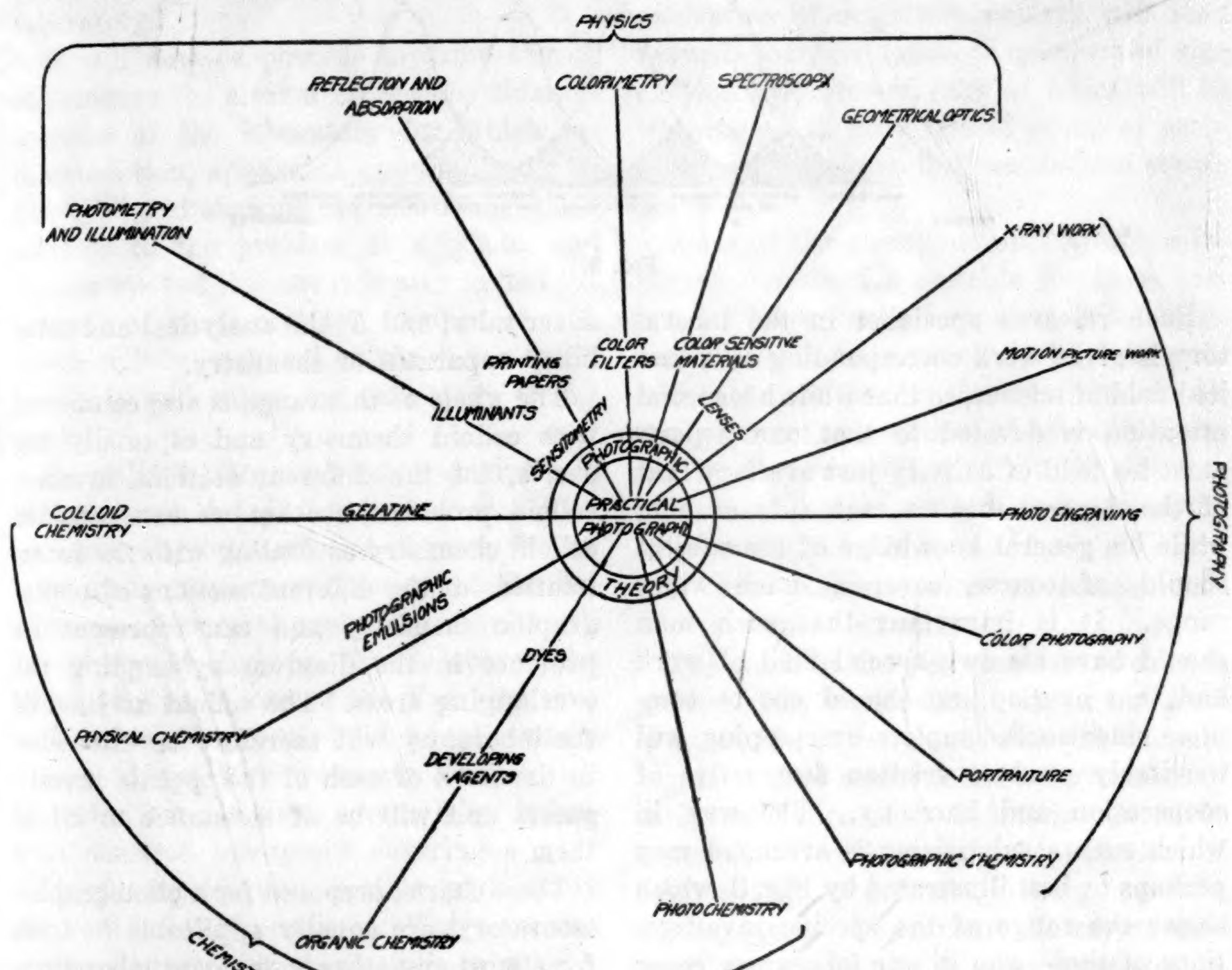

FIG. 2.

of the reactions which go on, both in the formation of the sensitive substance and in its subsequent development after exposure.

The organic chemist prepares the reducing agents required for development and the dyes by which color sensitiveness is given to the photographic materials and by which the art of color photography can be carried on, and while the physicist therefore deals with sensitometry and the theory of exposure, the chemist must deal at the same time with the theory of development and with the conditions relating to the development of photographic images.

A laboratory, therefore, for the study of photographic problems must be arranged with a number of sections such as are shown in Fig. 2. In physics we require departments dealing with sensitometry and with illumination, reflection and absorption, colorimetry, spectroscopy and geometrical optics. We need a department of colloid chemistry, one of physical chemistry, one of organic chemistry, one of photo-chemistry to deal with the action of light upon the plate, and finally a number of photo-

graphic departments, dealing with photographic chemistry, with portraiture, color photography, photo-engraving, motion picture work and X-ray work, and all these departments are converged together first upon the theory, and then upon the practise, of photography.

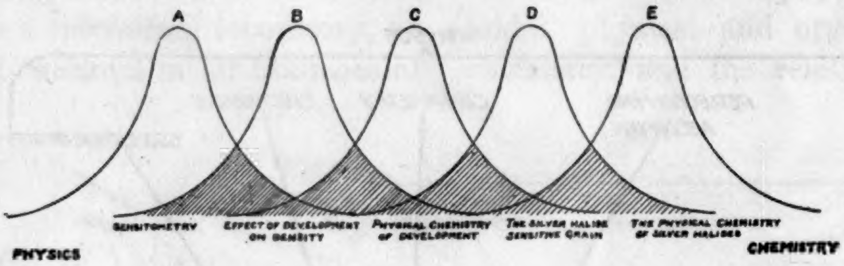

FIG. 3.

Each research specialist in the laboratory is given work corresponding to a limited field of science, so that while his special attention is devoted to that one department his field of activity just overlaps that of the departments on each side of him, while his general knowledge of the subject should, of course, cover a much wider range. It is important that each man should have his own special field of work and that overlapping should not be complete since such complete overlapping will inevitably produce friction destructive of cooperation and harmony. The way in which such a subdivision is arranged may perhaps be best illustrated by Fig. 3, which shows the range of the specific investigations of those who in our laboratory cover the range of research work between sensitometry and pure physical chemistry. There are five workers in this range; the first, *A*, being a pure physicist; *B*, a physicist with a considerable experience of chemistry; *C*, a physical chemist who has specialized in photography; *D*, a physical chemist who has specialized in photographic theory; and *E*, a pure physical chemist. The interest of each of these workers overlaps the field of the other workers but nevertheless each of them has his own specific problem, his own equipment and apparatus. Thus, *A* and *B* use sensitometric apparatus chiefly; *C*, both sensitometric apparatus and the thermostatic and electrical equipment of physical chemistry; *D*, microscopic apparatus and chemical apparatus dealing with the precipitation of silver salts; and *E*, the analytical and solubility apparatus of chemistry.

The whole of this range is also connected with colloid chemistry and especially the overlap of the different sections involves colloid problems, so that we can consider colloid chemistry as dealing with the interrelations of the different sections of photographic chemistry and can represent its province in the diagram by shading the overlapping areas. The colloid division of the laboratory will therefore be interested in the work of each of the specific investigators and will be of assistance to all of them.

These charts, prepared for a photographic laboratory, are equally applicable in form for almost any other convergent laboratory, so that if we have to work out the organization of a research-laboratory which is to study any inter-related group of problems, we can do it by the construction of charts similar to these. Thus, considering Fig. 1, we place first at the bottom of the chart the general subject considered and its various branches and then above these the scientific problems involved, separating out on opposite sides of the chart those problems which would involve different branches of pure science. Thus, we can place on one side

biological problems, then physical problems, then chemical problems and so on, so reconstructing a chart similar to Chart 1 from the bottom up until at the top we have the various branches of pure science involved, subdividing these branches until each subdivision represents the work capable of being handled by one man in the laboratory.

It will now be possible to draw Fig. 2, showing on the circumference the different sections of the laboratory for which accommodation, apparatus and men must be provided and showing the relation of these sections to the problem as a whole, and having worked this out it is easy to find the amount of space and the number of men which will be required or which the funds available will allow for each part of the work.

Specialized laboratories may originate in various ways, but it seems clear that with an increasing total amount of research and with an increasing realization of the importance of research more laboratories will be developed and no doubt laboratories which originally were of the divergent type will with their growth tend to split into a linked group of convergent laboratories. Consider, for instance, a very large industrial research laboratory covering a wide field of research and dealing with many different types of problems. There are two types of organization possible to such a laboratory. It might be divided according to the branches of science in which the workers were proficient. It might have, for instance, chemical divisions, physical divisions, and so on, but if the groups of problems dealt with were reasonably permanent in their character it would more probably develop into a group of convergent laboratories in which men from different branches of science—chemists, physicists and so on—worked together (and probably even had their working places in proximity) because they were working on the same general problem. Any national laboratory which is developed for industrial research, for instance, should almost certainly be organized as a group of convergent laboratories rather than as a group of separate physical, chemical, engineering, etc., laboratories.

We may expect then that the general organization of scientific research will tend towards the production of numbers of specialized laboratories, each of which will be working on an inter-related group of problems and attacking it from various standpoints.

Some of the questions relating to the internal organization suitable for these convergent laboratories have already been discussed in a former paper[2] and I need only add here that the "conference" system described there as a method of actually carrying on the scientific work of the research laboratory has continued to prove quite satisfactory.

2. THE CLASSIFICATION OF SCIENTIFIC KNOWLEDGE

The work of the research laboratories is published by various methods in the form of scientific papers, and with the increasing amount of research done the number of technical journals is increasing steadily, so that the workers in most branches of science find it difficult to keep up adequately with the current literature and especially those who become interested in the light thrown upon their own problem by other branches of science find it a task of great magnitude to acquaint themselves adequately with the literature. In order to meet this difficulty the various scientific societies publish journals giving abstracts in a conveniently indexed form of all the important papers published, and these abstract journals are of great value in searching for information on special subjects.

[2] "The Organization of Industrial Scientific Research," SCIENCE, 1916, p. 763.

In spite of these abstract journals the task of obtaining all the references to the literature on a given subject is still a formidable one and might be very much simplified by the adoption of some radical changes in the organization of the abstraction and classification of scientific knowledge.

In the first place, there seems to be no reason why abstracts of scientific papers should be prepared by the national societies. At present, for instance, there are at least four complete sets of abstracts of chemical papers prepared in different countries, together with a number of less complete sets, and this represents a great overlapping and duplication of effort. On the other hand, sciences which have not so many or so wealthy workers as chemistry can not afford to produce any complete abstract journals, so that in these sciences reference to the literature is much more difficult. There seems to be no reason why an interchange of abstracts between different countries could not be arranged and, indeed, it might be the best method of obtaining abstracts to have the author of a paper supply an abstract suitable in form and length for the abstract journal at the same time that he sends his paper in to the journal which publishes it. The editor of that journal could suggest modifications in the abstract which in his opinion were desirable and forward both the corrected and uncorrected abstract to the editor of the abstract office, where it would be re-edited for insertion in the international abstract journals and these journals would, of course, be supported by subscriptions either through the societies or individuals in the same way as the abstract journals which are at present published.

Whether such an ambitious scheme of international scientific abstracts is capable of realization or not, reference to the abstract journals would be made much simpler if some method of numerical classification could be adopted.

In this connection, an experiment has been made in the last two years at the laboratory of the Eastman Kodak Company which has proved successful and which seems to be worth trying on a larger scale. The laboratory publishes each month for the use of the employees of the company an abstract bulletin of the photographic journals, including also abstracts from other scientific journals which have any relation to photographic problems or manufacture, the abstracts being made by the laboratory staff, and attached to each abstract is a reference number. These numbers refer to a numerical classification of photography based somewhat on a decimal system but adapted to the special needs of the subject. Each month as the bulletin is issued the abstracts are clipped out, pasted on cards and filed under the number printed on them in numerical order so that each recipient of the bulletin can prepare for himself a file either of all photographic literature or of any portion of it in which he may be specially interested. For example, in the classification photographic apparatus commences with the number "2," and if any particular worker is not interested in anything but apparatus, if he has no interest in materials or in photographic processes or in applications of photography, then he need only file the cards starting with "2," while, if his interests are even more limited, if, for instance, he is interested only in photographic shutters, he can file the cards starting with "262" thus obtaining only a very limited file which is, however, complete for the subject in which his interest lies.

If the abstract journals would print such a numerical classification attached to each abstract, adopting as their basis either the numerical classifications of the international catalogue of scientific literature,

which have proved themselves satisfactory after trial, or some different classification adopted after due consideration, then each recipient of the abstract journals could prepare for himself card index files of the scientific literature in which he was interested.

To prepare a card index of all science or even a complete index of one large branch of science in this way would be too formidable an undertaking either for an individual or even for a small library, but it should certainly be possible for large libraries such as those of the scientific societies or of large cities to keep such numerically indexed files to which reference could be made by correspondence from any research worker. Thus, adopting the classification of the international catalogue, a worker who became interested in questions, *e. g.*, of catalysis, could apply for a copy of the reference cards on this subject, which would include all those indexed under 7065 and could be supplied with a complete file or with a partial file covering any period of time; the copies could easily be made by photographing the cards with such a camera as the "Photostat."

3. THE UTILIZATION OF SCIENTIFIC KNOWLEDGE

The actual application of science to industry is so vast a subject that it can not be considered here, but it is not satisfactory to leave the results of research at the point where they are published in papers and filed in the abstract journals. In order to make them available as a part of scientific knowledge the new information as it is obtained must be incorporated in books.

There are three classes of books dealing with scientific work which require separate consideration. The first class comprises the dictionaries, in which almost all the progress in some branches of science can conveniently be summarized. Beilstein's "Handbook of Organic Chemistry" is a good example of the way in which almost all the facts of a science can be absorbed in a classified form and made available for ready reference. These dictionaries, in fact, represent the critical and discriminating summary of the scientific publications on the subjects with which they deal and the preparation of such dictionaries should be ensured by international cooperation of the national societies.

Other sciences, however, do not by their nature lend themselves to the convenient preparation of dictionaries and what is wanted in this case are critical and well arranged handbooks covering the whole science and resuming impartially but critically the various additions which are made from time to time in the different branches of the subject. These handbooks as well as the dictionaries would, of course, require the addition of supplementary volumes from time to time and occasional complete revision.

The preparation of both dictionaries and handbooks would, of course, be greatly facilitated by the existence of a numerically classified card index to the literature concerned, and the preparation and revision of such books might well be undertaken in connection with the large libraries having in their possession the complete classified card indexes.

On the other hand, for the assistance of advanced students of science, what is required is a steady supply of monographs correlating critically and comprehensively all the literature in a special field, and these must be brought up-to-date from time to time. Such monographs are especially required in connection with rapidly developing new branches of science; it is difficult to overestimate the importance and value for progress in research of such a book as Bragg's "X-Rays and Crystal Structure"

for instance, and while nothing should be done to hinder individual initiative in publishing such books, it would seem that when it was apparent that some branch of science required such a monograph a national society might very well approach well-known workers in the field and request them to write such a book, offering its assistance in the matter of bibliography and also offering to arrange for the publication of the manuscript. The initiative in indicating the need for such a book might come in the form of suggestions from members of the society or other scientific men. It is quite true that at the present time the scientific publishers are extremely active in searching for suitable books to publish, but necessarily they must consider the probable demand rather than the actual need for a book, and this leads to an over-production of books dealing with those fields of science which have a large following and an insufficient supply of books in those fields where the workers are few, though for progress the more sparsely worked fields would seem to require almost as much representation in literature as those which are of wider interest.

C. E. KENNETH MEES

RESEARCH LABORATORY,
EASTMAN KODAK COMPANY,
ROCHESTER, N. Y.,
October 26, 1917

THE DEPARTMENT OF AGRICULTURE AND THE FOOD SITUATION[1]

ACCORDING to the calendar it is almost a year to the day since my last meeting with you. Judged by the experiences through which we have passed, it seems more like a generation. Then this country was at peace, though its patience was being sorely tried. Now it is at war for reasons which I need not discuss before this body. It had no alternative. It either had to fight or to admit that it had no honor, was not a free nation, and would henceforth be subjected to a medieval power that in the last analysis knows no law but might. The nation was living on a peace basis and was not fully prepared for war in any respect; but it was fortunately circumstanced in the character of its agricultural organization and the number and efficiency of its expert agencies.

The nation may well pride itself on the fact that it had had the foresight generations ago to lay deep its agricultural foundations. I congratulate the representatives of the land grant colleges on the fine opportunity for service presented to them and on the splendid way in which they have seized it. The Department of Agriculture has had great comfort in the thought that these institutions, ably planned and wisely directed, existed in every part of the nation and stood ready not only to place themselves at the service of the national government but also to take the initiative in a vast number of directions.

When a state of war was declared on April 6, the food situation was unsatisfactory. The need of action was urgent and the appeal for direction was insistent. The nation looked for guidance primarily to the federal department and to the state agencies which it had so liberally supported for many generations. It was not disappointed. In a two-days' session at St. Louis, the trained agricultural officers of the country conceived and devised a program of legislation, organization and practise the essential features of which have not been successfully questioned and the substantial part of which has been enacted into law and set in operation. This great democracy revealed its inherent strength.

To the normal forces of the government leading with agriculture and rural problems there has been added an emergency agency with great and unusual powers, with enormous possibilities for good, and with a remark-

[1] From an address given by Secretary of Agriculture Houston, addressing the Thirty-first Annual Convention of the Association of American Agricultural Colleges and Experimental Stations in Washington on November 14.

able record for achievements already to its credit. It has enlisted in its ranks men of wide experience, fine spirit, and high ideals, many of whom are gladly volunteering their services for the common cause. I refer to the Food Administration under the direction of Mr. Hoover.

The relation between this agency and the other organized agricultural forces of the nation is intimate and fundamental. It is impossible completely to disassociate them and it would be undesirable to do so.

The problem in part is a common one, and it is of the first importance that the work be done in the closest cooperation and with an eye single for the public good. There is no need for undue duplication of effort and no causes of friction which can not be removed through an intelligent conception by each agency of the powers and purposes of all and by a spirit of mutual accommodation. In a broad way it is agreed that the prime function of the Department of Agriculture shall be the stimulation of production, the conservation of products on the farm through all the normal and approved processes, the promotion of better marketing and distribution of products from the farms to the markets, the prosecution of the work in home economics along usual lines, the dissemination of information, and the extension of all these activities as authorized by law. In a similar way the principal function of the Food Administration is the control and regulation of commercial distribution of foods; that is, of products which have reached the markets, are in the channels of distribution or in the hands of consumers, their conservation by consumers, the elimination of waste, and the handling of foods and feeds in the market by legal means through its regular officials as well as through its volunteer agencies.

In the main the Department of Agriculture deals with all the processes of farming up to the time products reach the market until they are in the requisite form for consumption and are available for the purpose. At this point the Food Administration enters and exercises its wide powers of regulation, direction, and suggestion. Where the Food Administration through its powers can be of assistance to the Deparament of Agriculture in its field, it is at liberty freely to make suggestion, and, when necessary, to cooperate in execution; and the same relation obtains as to the department's participation in Food Administration matters in which it has a vital interest and toward the promotion of which it can be of assistance. This is the substance of the agreement originally entered into between the Food Administration and the Department of Agriculture, and will be more satisfactorily observed as the agents and divisions of the two departments familiarize themselves more fully with their tasks and with the prescribed lines of effort.

Obviously the making of a program for the agricultural activities of the nation did not end with the St. Louis conference. Thought, action, and cooperation between the members of this association and other state agencies on the one hand and the federal department on the other have been continuous. Attention has been given without cessation to problems in the field of labor. It was obvious that difficulties would be presented and that apprehension would run beyond the actual condition. An army could not be raised without taking men from every field of activity; and it would have been unfair to any class of workers in the community to have proposed its exemption. It was impossible in the haste of the first draft satisfactorily to work out in detail the principle of selective service; but, nevertheless, under the regulations, consideration was given throughout by exemption boards and by the officers of the War Department to the needs of agriculture. With ampler time at its disposal, the War Department has worked out a system of classification which gives due regard to the necessity of retaining skilled farmers and expert agricultural leaders on the farms and ranches and in the educational and administrative services.

THE PITTSBURGH MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE opening session will be held on Thursday evening at 8 o'clock in the Carnegie Music Hall. After general announcements concerning the Convocation Week meetings, the retiring president of the Association, Dr. Charles R. Van Hise, will deliver his address on "The economic effects of the world war in the United States." Following the president's address, a reception will be tendered to the members of the association and the affiliated societies in the foyer of the Music Hall.

The addresses of the retiring vice-presidents, to be delivered throughout the week, are as follows:

Section A. Luther P. Eisenhart The Kinematical Generation of Surfaces.

Section B. Henry A. Bumstead. Present Tendencies in Theoretical Physics.

Section C. Julius Stieglitz. The Electron Theory of Valence and its Application to Problems of Inorganic and Organic Chemistry.

Section D. Henry M. Howe. Some Needs of Engineering.

Section E. Rollin D. Salisbury. The Educational Value of Geology.

Section F. George H. Parker. An Underlying Principle in the Architecture of the Nervous System.

Section G. C. Stuart Gager. The Near Future of Botany in America.

Section H. Frederick W. Hodge. The Ancient Pueblo of Hawikuh.

Section I. Louis I. Dublin. The Significance of our Declining Birth Rate.

Section K. Edwin O. Jordan. Food-borne Infections.

Section L. (Leonard P. Ayres absent—no address.)

Section M. Whitman H. Jordan. The Future of Agricultural Education and Research in the United States.

The symposia, as far as announced, are as follows:

Section F. The Value of Zoology to Humanity.

Section E. Mineral Resources and Chemical Industries.

Section H. The Contributions of Psychology to the War.

Section G. Forestry Problems after the War, and War Work of the Botanical Committee of the Council of National Research.

Section I. Economic Problems based upon the World War.

Section K. The Food Problem of to-day (or the Lessons of the War in Medicine).

Section B. The Relationship of Physics to the War. (In cooperation with the Council of National Defense.)

The Council will meet daily at 9 A.M., at the Schenley Hotel, which will be the hotel headquarters.

Owing to the unprecedented demand for railroad service for the nation's defense, preferential rates for individual travel have been tentatively abandoned. The *New England Passenger Association*, however, has authorized local fares in each direction to its boundary points going and returning via same route only and over which one-way tickets are regularly sold—one and one half westbound differentials to apply, added to fares tendered. The *Trunk-Line Association* has authorized the following: "Two cents a mile in each direction, with minimum of $1 for the round trip, going and returning via same route only; tickets to be sold and good, going, December 26 to 28, and returning to reach original starting point not later than January 5, 1918." All members living beyond the boundaries of the above passenger association territorities should consult their local passenger ticket agents. Members from west of the Mississippi should consult their local ticket agents for trans-continental and winter tourist rates.

The following affiliated societies have indicated their intention to meet in Pittsburgh during Convocation Week:

American Federation of Teachers of the Mathematical and the Natural Sciences.—Will hold council meeting on Saturday, December 29, 1917, 10 A.M. President, C. Riborg Mann. Secretary, William A. Hedrick, Central High School, Washington, D. C.

American Physical Society.—Will hold meetings

on Thursday, Friday and Saturday, December 27 to 29, 1917, in joint session with Section B, A.A.A.S. President, R. A. Millikan. Secretary, Alfred D. Cole, Ohio State University, Columbus, Ohio.

Optical Society of America.—Will meet on Monday, December 31, 1917. President, Perley G. Nutting, Westinghouse Research Laboratory, East Pittsburgh, Pa.

American Electrochemical Society.—The Pittsburgh Section will meet on either Saturday, December 29, 1917, or Wednesday, January 2, 1918. President, Colin G. Fink. Secretary, Pittsburgh Section, C. G. Schleuderberg, East Pittsburgh, Pa.

Society for the Promotion of Engineering Education.—Will hold meetings on dates to be announced. President Milo S. Ketcham. Secretary, F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Illuminating Engineering Society.—Will hold meetings on dates to be announced. President, G. H. Stickney. Chairman, Committee on Reciprocal Relations, W. A. Durgin, 72 West Adams St., Chicago, Ill.

Paleontological Society of America.—Will meet on Monday to Wednesday, December 31, 1917, to January 2, 1918. President, John C. Merriam. Secretary, R. S. Bassler, U. S. National Museum, Washington, D. C.

Seismological Society of America.—Will meet on dates to be announced. President, J. B. Woodworth. Secretary, S. D. Townley, Stanford University, Cal.

American Society of Naturalists.—Will meet on Tuesday and Wednesday, January 1 and 2, 1918. President, George H. Shull. Secretary, Bradley M. Davis, University of Pennsylvania, Philadelphia, Pa.

Entomological Society of America.—Will meet on Friday and Saturday, December 28 and 29, 1917. President, Lawrence Bruner. Secretary, J. M. Aldrich, U. S. Bureau of Entomology, West Lafayette, Ind.

American Association of Economic Entomologists.—Will meet Monday to Wednesday, December 31, 1917, to January 2, 1918. President, R. A. Cooley. Secretary, Albert F. Burgess, Melrose Highlands, Mass.

Ecological Society of America.—Will meet Saturday, Monday and Tuesday, December 29, 31, 1917, and January 1, 1918. President, Ellsworth Huntington. Secretary, Forrest Shreve, Easton, Maryland.

American Nature-Study Society.—Will meet on dates to be announced. Secretary, Mrs. Anna B. Comstock, Cornell University, Ithaca, N. Y.

Wilson Ornithological Club.—Will meet on Tuesday and Wednesday, January 1 and 2, 1918. President, W. F. Henninger. Acting Secretary, T. C. Stephens, Morningside College, Sioux City, Iowa.

Botanical Society of America.—Will meet on Friday, Saturday, Monday and Tuesday, December 28, 29 and 31, 1917, and January 1. President, F. C. Newcombe. Secretary, H. H. Bartlett, University of Michigan, Ann Arbor, Mich.

American Phytopathological Society.—Will meet Friday to Wednesday, December 28, 1917, to January 2, 1918. President, Mel T. Cook. Secretary, C. L. Shear, U. S. Department of Agriculture, Washington, D. C.

Society for Horticultural Science.—Will meet Thursday to Saturday, December 27 to 29, 1917. President, T. C. Johnson. Secretary, C. P. Close, College Park, Maryland.

American Microscopical Society.—Will hold meetings on Saturday, December 29, 1917, for transaction of business only. President, M. F. Guyer. Secretary, T. W. Galloway, Beloit College, Beloit, Wis.

American Fern Society.—Will meet on dates to be announced. President, William Palmer. Secretary, C. A. Weatherby, 1062 Main St., East Hartford, Conn.

American Psychological Association.—Will meet on Thursday to Saturday, December 27 to 29, 1917, President, R. M. Yerkes. Secretary, H. S. Langfeld, Harvard University, Cambridge, Mass.

American Metric Association.—Will meet on dates to be announced. President, George Frederick Kunz. Secretary, Howard Richards, Jr., 156 5th Avenue, New York, N. Y.

Society of American Foresters.—Will meet on dates to be announced. President, Filibert Roth. Secretary, Elmer R. Hodson, U. S. Forest Service, Washington, D. C.

School Garden Association of America.—Will meet on Monday, December 31, 1917. President, Evrie Kilpatrick, 124 West 30th Street, New York, N. Y.

Society of the Sigma Xi.—Will meet on Saturday, December 29, 1917. President, Julius Stieglitz. Secretary, Henry B. Ward, University of Illinois, Urbana, Ill.

Gamma Alpha Graduate Scientific Fraternity.—Will hold annual convention and dinner on date to be announced. President, Norman E. Gilbert, Dartmouth College, Hanover, N. H.

Phi Kappa Phi Fraternity.—Will meet on Saturday, December 29, 1917. President General, Edwin E. Sparks. Secretary General, L. H. Pammel, Iowa State College, Ames, Iowa.

Gamma Sigma Delta.—Will meet on dates to be announced. President, A. V. Storm. Secretary, L. H. Pammel, Iowa State College, Ames, Iowa.

SCIENTIFIC EVENTS

SMITHSONIAN EXCAVATIONS IN NEW MEXICO

An expedition organized by the Bureau of American Ethnology of the Smithsonian Institution and the Museum of the American Indian, Heye Foundation of New York City, under the immediate direction of Mr. F. W. Hodge, ethnologist-in-charge of the Bureau mentioned has concluded its first season of excavating among the ruins of Hawikuh in western New Mexico. This pueblo was one of the famed "Seven Cities of Cibola" which was seen by Marcos de Niza, a Franciscan Friar, in 1539 and was the scene of the death of his negro guide and companion. In the following year the pueblo was stormed by Francisco Vasquez Coronado, the celebrated Spanish explorer, who almost lost his life in the attack. The Zuni occupants of Hawikuh fled to their stronghold a few miles away; the Spanish took possession of their village, which Coronado called Grenada, and while there wrote his report to the Viceroy of Mexico, giving an account of his expedition up to that time and sending various products of the country and examples of native art.

The excavations were commenced at the close of May by Mr. Hodge, assisted by Mr. Alanson Skinner and Mr. E. F. Coffin of the Museum of the American Indian. Work was begun in a great refuse heap forming the western slope of the elevation on which Hawikuh is situated. This refuse was found to contain many burials of Zuni dead, of which there were three types—remains cremated and deposited in cinerary vessels accompanied by food and water vessels; others buried at length, or in abnormal postures without accompaniments; and usually dismembered; others still deposited at length with head directed eastward and with them numerous vessels of earthenware, great quantities of food, and the personal tools and ornaments of the deceased. In all, 237 graves were opened during the three months devoted to the work, in which quantities of pottery vessels of various forms and with a great range of decorative painting, were uncovered. Among burials of the third type mentioned were several skeletons of members of the Zuni Priesthood of the Bow, with their war paraphernalia, including bows and arrows, sacred paint, war clubs, and their personal or ceremonial belongings.

A Franciscan mission was established at Hawikuh in 1639 and continued in operation until 1670 when the pueblo was abandoned on account of Apache depredations. Considering the length of time since the village was forsaken by its inhabitants, the remains were in a remarkably good state of preservation. The deposit of great quantities of food in the graves, especially boiled corn on the cob, had the effect of decaying the bones but of preserving the materials that usually more readily perish, such as baskets, fabrics, and objects of wood, many of which were saved by immediate treatment. Many very beautiful things found in association with the remains include 8 objects of turquoise mosaic, consisting of ornamental hair combs, ear pendants, and hair ornaments, some of which are so well executed as to be among the finest examples of encrusted turquoise ever found in America, and far exceeding the mosaic work of the Hopi Indians in Arizona to-day. Of the fabrics various examples were recovered, and indeed in one instance the clothing of a woman was so well preserved that it was possible to study the character of her dress from neck to feet.

The pottery of the Hawikuh people, as mentioned, possesses a wide range of decoration and coloring. Most of the designs are geometric, but numerous highly conventionalized figures of birds, as well as many lifelike forms of quadrupeds, the eagle, the butterfly, the tadpole, and the corn plant were found. Many of the vessels are decorated with a distinct glaze, black and green predominating. The vessels consist chiefly of bowls, ranging

in size from tiny toy affairs to some as large as fifteen inches in diameter; but there are also large and small water jars, and black, undecorated cooking pots, duck-shaped vessels, and the like.

The finds include, among others, the ceremonial paraphernalia of a medicine man, comprising his medicines; a turkey's egg containing the bones of the embryo and accompanied with a food bowl; several skeletons of eagles, turkeys, and dogs that had been ceremonially buried, and deposits of pottery that had been broken in sacrifice and deposited in the cemetery not as burial accompaniments. It was the custom of the Zunis of Hawikuh to "kill" all the vessels deposited with their dead by throwing them into the graves, and this was likewise the case with other household utensils such as metates and manos used in grinding corn. Some of the vessels escaped injury, while all of the fragments of the broken ones were carefully gathered and will be repaired.

The site of Hawikuh covers an area of about 750 by 850 feet, so that only a comparatively small part of the site was excavated during this season. The refuse was found to attain a depth of 14½ feet in the western slope and it will probably be found to reach a depth of at least 18 feet before the walls of the summit of the elevation are reached. An interesting discovery consists of the remains of many walls entirely beneath this great deposit of refuse, showing that the site was occupied in prehistoric times long before Hawikuh itself was built.

PROGRESS IN COMBATING HOOKWORM

THE recently published annual report of the Rockefeller Foundation records the results of intensive work on the study and control of hookworm and malaria. The report as quoted in the *Boston Medical and Surgical Journal* states that during the year 1916 the work of the International Health Board continued to be directed chiefly toward the relief and control of hookworm disease. In cooperation with the government, systematic efforts toward control have now been inaugurated in eight of the Southern states and in fifteen foreign countries, located between degrees of latitude 36 north and 30 south in the tropical and sub-tropical belt, which is the native habitat of the hookworm. New fields of operations in 1916 were Salvador, Brazil, Ceylon, and Siam. Arrangements were also completed to start work early in 1917 in the Fiji Islands, in Papua, and in Queensland, Australia.

In British Honduras and the island of Barbados, preliminary infection surveys were made, and in the Yangtsekiang valley of Central China a preliminary survey was carried out with special reference to the problem of soil pollution in shallow mining operations.

The board conducted during the year a series of four experiments in malaria control. Three were finished. The fourth will be completed in 1917. The object of all four experiments was to determine the degree to which malaria could be controlled within the limits of reasonable expenditure and under conditions prevailing in typical farm communities of the South. Gratifying results have been obtained.

Two commissions were sent to South America. One, composed of six sanitarians, with Maj.-Gen. William C. Gorgas as chairman, visited the republics of Ecuador, Peru, Colombia, Venezuela and Brazil, to study yellow fever conditions. Two definite objects were sought: (1) to determine the status of doubtful endemic centers of infection; (2) to ascertain what measures were necessary and feasible to eradicate the disease from the localities responsible for its dissemination. The second commission investigated medical education and public health agencies in Brazil.

Active measures to control and prevent hookworm disease are now in operation in Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas and Virginia; in Antigua, Grenada. St. Lucia, St. Vincent and Trinidad of the West Indies; in British Guiana and Dutch Guiana; in Costa Rica, Guatemala, Nicaragua, Panama and Salvador of Central America; in

Brazil, and in Ceylon and Siam of the Far East.

Four experiments in malaria control were carried out during 1916 at different points in the Lower Mississippi River Valley. In each a different line of investigation was pursued, the object being to discover a practical method of control which the average rural community could afford.

An experiment was conducted under the administration of the Mississippi Department of Health, with Dr. W. S. Leathers as administrative director and Dr. C. C. Bass of Tulane University as scientific director. The practicability of control through detecting the carriers and freeing them of the malaria parasites was tested. The experiment covered 225 square miles of territory, the size of the communities varying from nine to sixteen square miles, with an average population of 1,000. Adjoining communities were taken up, one after another, as facilities permitted, the work in each lasting about four weeks with subsequent visits to insure thoroughness. Blood tests were taken, quinine treatment was given to those found infected. The experiment will be continued in 1917.

THE BRITISH COMMITTEE FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

The second annual report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1916–17 has been published. According to an article in *Nature* it consists of an introductory statement by Lord Curzon, as lord president of the privy council, the report of the Advisory Council, signed by Sir William McCormick and Sir Frank Health, and appendices giving orders in council, terms of the imperial trust, documents relating to research associations, and names of members of committees attached to the department of scientific and industrial research. Lord Curzon points out in his introduction that the foundation of the department led to the creation of the imperial trust for the encouragement of scientific and industrial research.

The trust holds on behalf of the department the sum of one million sterling which Parliament has voted for the purposes of the department. The negotiations of the advisory council with the leading manufacturers in the various industries showed that it would not be possible to develop systematic research on a large scale unless the government were in the position to assist financially over an agreed period of years. These considerations led the government to place a fund at the disposal of the privy council committee to be spent over a period of five or six years afforded the best means of dealing with the problem. During the past year negotiations have been concluded with the Royal Society for the transfer of the property of the National Physical Laboratory, together with the responsibility for its maintenance and development, to the department of scientific and industrial research. The scientific management of the laboratory will remain in the hands of the executive committee under the chairmanship of Lord Rayleigh, a member of the advisory council.

The committee reported last year that grants had been approved to a number of individual students and research workers for the year 1916–17 to an amount not exceeding 6000*l*. The amount actually expended under this head, however, was not more than 3550*l*. upon thirty-six workers. Throughout the work has suffered in amount owing to the war, and the committee was unable to expend more than 14,524*l*. out of the 40,000*l*. placed at its disposal by Parliament for the financial year 1916–17. During the current year a sum of 38,050*l*. was taken in the estimates, in addition to the fund of a million referred to already. The annual vote is intended to cover (*a*) the cost of those researches which will not be undertaken by the proposed research associations; (*b*) the grants to individual research workers, both students and others; and (*c*) the cost of administration.

The report says:

> The one question of policy, to which throughout the year we have continuously devoted our attention, is the working out, with all the care and advice we have been able to command, of the policy of cooperative industrial research foreshadowed in our last report. Lord Crewe, who was at that

time lord president of the privy council, received a deputation of the board of scientific societies on December 1 last, at which he outlined the policy of the government in regard to industrial research. He announced their intention to ask parliament to place a large fund—a million sterling—at the disposal of the department to enable it to cooperate with the industries of the country in the foundation and maintenance of approved associations for research during the next five years or so. After these initial years it is expected that the larger industries, at any rate, will be able and willing to carry on the work of the associations without assistance. The intention of the government is to make a contribution to the assured income of such associations from the subscriptions of their members, varying in amount according to circumstances, and with a normal maximum of pound for pound, though in very exceptional cases this limit may be exceeded. Lord Crewe also announced that the board of inland revenue would be prepared to instruct surveyors of taxes to allow as a working expense for income-tax purposes the contributions by traders to industrial associations formed for the purpose of scientific research for the benefit of the various trades. The allowance would be subject to certain conditions; that is to say, the association must be under government supervision and the trader's contribution must be "an out and out payment, made from his trade profits and giving him no proprietary interest in the property of the association." Since this decision includes war profits and excess profits taxes, it offers a considerable inducement to firms affected by these taxes to act promptly.

A TRIBUTE TO PROFESSOR CHURCH

THE College of Civil Engineering of Cornell University paid a tribute of affection and respect to the emeritus professor of applied mechanics and hydraulics, Irving Porter Church, '73, on November 9. Alumni of the college presented to the university a portrait of Professor Church and the sum of $2,500 in Liberty Bonds to form the Irving P. Church Fund, the income of which is to be devoted to the purchase of additions to the library of the college.

According to the *Cornell Alumni News,* a simple ceremony of presentation took place at noon in the auditorium of Goldwin Smith Hall. Among the persons assembled were Mr. White and Professors Law, Hewett, Comstock, and Gage—men whose terms of service in the faculty are comparable in length to that of Professor Church; Mrs. Crandall; the members of the faculty of civil engineering, and a number of other professors.

On the rostrum, veiled, was the portrait lately completed by J. Campbell Phillips. Dean Haskell expressed the pleasure of the faculty of civil engineering in taking part in this tribute to a beloved teacher, and introduced William D. Kelley, '80, the representative of the alumni committee which the Cornell Society of Civil Engineers had appointed to provide the double memorial. Mr. Kelley gracefully expressed the affection of the old students for Professor Church and their sense of his great services to the college and to engineering science during so many years. The contributions to this testimonial, he said, had come from Cornell engineers in all parts of the world. He unveiled the portrait and presented it to the university. Then he took from his pocket the Liberty Bonds constituting the Church Fund and handed them to President Schurman.

The President accepted the gifts in behalf of the university. He congratulated the alumni of the College of Civil Engineering on the value of their testimonial and still more on the propriety of their gift. What other offering, he asked, could be more grateful to a teacher than this double memorial? The whole university, he said, would be forever in debt to Professor Church's character and scholarship.

Everybody arose as Professor Church advanced to the front of the platform. He apologized for his presence there. What need for him to talk, he said, when a speaking likeness was there to represent him. He accepted gratefully the tribute of his old students, and spoke for a few minutes of his reminiscences of the forty-eight years he had spent at Cornell.

The board of trustees next day adopted this resolution: "First, that the communication of Mr. F. W. Scheidenhelm, chairman of the committee, be spread on the minutes of this board; secondly, that the sincere

thanks of the Trustees be tendered to the committee in charge and to all the Cornell men who have contributed to the gift for this admirable and appropriate tribute to Professor Church; and, thirdly, that it be referred to the dean of the college of civil engineering to hang the portrait in a suitable place."

SCIENTIFIC NOTES AND NEWS

Dr. Franklin P. Mall, professor of anatomy in the Johns Hopkins University and director of the department of embryology of the Carnegie Institution of Washington, died in Baltimore on November 17.

The anniversary address of the New York Academy of Medicine was delivered on November 15 by Dr. Henry Fairfield Osborn, L.L.D., president of the American Museum of National History, on "The origin and nature of life."

At its meeting held November 14 the Rumford Committee of the American Academy of Arts and Sciences voted the following appropriations: To Professor Raymond T. Birge, of Syracuse University, $150 in aid of his research on the Structure of Series Spectra; to Professor Theodore W. Richards, of Harvard University, $250 in aid of the publication of Marie's Tables of Physico-Chemical Data; to Professor Ancel St. John, $500 for the purchase of a refrigerating machine and accessories to be the property of the committee and loaned to Dr. St. John for use in connection with his researches on crystal structure by means of X-Rays.

Professor J. F. Kemp, for many years head of the department of geology in Columbia University, has become associated temporarily with the firm of Hager Bates and Lewis of Tulsa, Oklahoma, during the absence of Whitney Lewis in France.

Gustave R. Tuska, consulting engineer, New York City, formerly chief engineer of the Panama Railroad Company and lecturer in engineering at Columbia University, has been commissioned as major in the Engineer Section of the Officers' Reserve Corps of the United States Army.

Major John M. T. Finney, M. R. C., U. S. Army, has been appointed director of general surgery with the American Expeditionary Forces in France; Major Hugh H. Young, M. R. C., director of venereal skin and genito-urinary surgery, and Lieutenant-Colonel Joseph Eiler, M. C., U. S. Army, director of the laboratory service.

It is announced that Dr. Hugh Cabot of British Base Hospital No. 22 has been made lieutenant colonel of the Royal English Medical Corps. He has succeeded Lieutenant-Colonel Sir Allan Perry as commanding officer of the hospital. This is in addition to being chief surgeon, which position he has held for some months.

Dr. A. B. Cordley, dean of agriculture and director of the Oregon Experiment Station, has been elected chairman of the State Lime Committee, authorized by the state legislature to build and operate a state-owned lime plant for providing cheap agricultural lime.

Dr. Caroline Rumbold, formerly collaborator in forest pathology, Bureau of Plant Industry, has been appointed assistant pathologist in the Office of Sugar Plant Investigations, Bureau of Plant Industry.

The sulphur committee of the War Industries Board has recently visited Texas. The committee consists of J. Parke Channing, J. W. Malcolmson, A. B. W. Hodges, P. S. Smith, of the U. S. Geological Survey, and W. O. Hotchkiss of the University of Wisconsin.

The course of popular scientific lectures of the California Academy of Sciences, Golden Gate Park, is being continued on Sunday afternoons in the Auditorium of the Museum in Golden Gate Park, as follows:

November 18. Professor G. A. Louderback, geology department, University of California, "A geological expedition into the interior of China." (Illustrated.)

November 25. Professor E. C. Franklin, chem-

istry department, Stanford University, "Liquid air." (With demonstrations.)

December 2. Dr. A. A. D'Ancona, member of San Francisco Board of Education, "Circulation of the blood." (Illustrated by motion pictures.)

December 9. Miss Alice Eastwood, curator, department of botany, California Academy of Sciences, "Weeds." (Illustrated.)

THE series of lectures on heredity presented before the Washington Academy of Sciences and later published in the *Journal* of the academy has now been reprinted in collected form. The volume contains the following addresses:

Dr. H. S. Jennings. "Observed changes in hereditary characters in relation to evolution."

Dr. Oscar Riddle. "The control of the sex ratio."

Dr. W. E. Castle. "The rôle of selection in heredity."

The collected papers bound in buckram in uniformity with the preceding series of lectures on "Nutrition" may be obtained from the treasurer of the academy, Mr. William Bowie, U. S. Coast Survey, Washington, D. C.

MR. CARLETON R. BALL, agronomist in charge of Western Wheat Investigations, U. S. Department of Agriculture, delivered a lecture on "The Scope and Problems of Agronomy" before the students in agronomy at the Maryland Agricultural College, on November 8.

THE American Phytopathological Society will meet at Pittsburgh, December 28, 1917, to January 3, 1918, in affiliation with the American Association for the Advancement of Science. There will be joint meetings of the society with Section G of the association and also with the Botanical Society of America.

SECTION E—Geology and Geography—of the American Association for the Advancement of Science, will hold meetings at Pittsburgh, Pa., on Friday and Saturday, December 28 and 29, with a session on Monday, December 31, provided enough papers are offered by geologists returning from the meetings of the Geological Society of America in St. Louis to make a Monday session desirable. A symposium upon the topic "Mineral Resources and Chemical Industry," to be held jointly with Section C, is planned for Friday, December 28. The address of the retiring vice-president of Section E, Professor Rollin D. Salisbury, of the University of Chicago, upon "The Educational Value of Geology," will be given on Saturday morning, December 29, at 10 o'clock. The meetings of Section E will be presided over by Professor George H. Perkins, of the University of Vermont. Titles of papers to be read before the Section should be in the hands of the secretary, Dr. Rollin T. Chamberlin, University of Chicago, before December 15. Members who can only attend a session on Monday, December 31, and who wish to present papers at that time are requested to notify the secretary as soon as pos-

THE *Journal of the American Medical Association* states that the second American orthopedic contingent, composed of forty-two medical officers under the direction of Major Goldthwaite, has arrived in England. All the officers as well as three of engineering experience commissioned in the sanitary corps are to take charge of the development of curative workshops in the American orthopedic hospitals in France. There are also twelve orthopedic nurses as a nucleus around which a nursing staff is to be developed. All the medical staff except the director are to be distributed temporarily through the British orthopedic centers. Arrangements have been made by which these centers can be used for training Americans in orthopedic work with the idea of providing relief for the large number of medical officers that will be required for this special work. When these men are needed for service in the American hospitals in France, another group will be sent from home to take their place in the British hospitals. The rotation will be continued until the American hospitals are fully staffed. Major Goldthwaite is going on to American headquarters in France to organize the orthopedic hospital with the American Army.

Before the Chemical Society, London, the following lectures will be given: December 6, "The Relation between Chemical Constitution and Physiological Action," Dr. F. L. Pyman; February 21, 1918, "Recent Studies on Active Nitrogen," Professor the Hon. R. J. Strutt; April 18, the Hugo Müller lecture, entitled "The Old and the New Mineralogy," Sir Henry A. Miers.

Dr. Richard Weil, professor of Experimental Medicine in Cornell Medical College, a major in the Medical Reserve Corps and chief of the medical staff of the Base Hospital at Camp Wheeler, Macon, Ga., died of pneumonia on November 19.

Nature states that in a private letter Dr. Paul Bertrand announces the death of his father, Professor C. E. Bertrand, the distinguished plant-anatomist and paleobotanist. Dr. Bertrand was professor of botany at Lille, and lived there for the last three years of his life under German rule. Under these difficult conditions, he was still able to carry on both his university courses and his private research, as long as his health permitted.

The death is announced, on October 27, of Mr. Worthington G. Smith, of Dunstable, fellow of the Linnean Society, at eighty-two years of age and on October 24, at fifty-four years of age, of Mr. George T. Holloway, vice-president of the Institution of Mining and Metallurgy, known as a consultant metallurgist and assayer.

Mr. George Charles Crick, assistant in the geological department of the British Museum, died on October 8, aged sixty-one years.

EDUCATIONAL NOTES AND NEWS

The Probate Court has allowed the will of Mrs. Augusta E. Corbin, by the terms of which Boston University receives $555,000.

Extensive additions are to be made to the laboratories of the department of chemistry of the Rensselear Polytechnic Institute. Entirely new and complete laboratories will be constructed for quantitative analysis, for organic chemistry and for physical chemistry. Material enlargement will be provided for the food analysis and gas analysis laboratories, and new space assigned for lecture room and recitation room needs. The great increase in number of students entering for the course in chemical engineering has demanded these extensions. Work on the new construction will be started in March, 1918, at which time also ground will be broken for four new dormitories.

Dr. F. L. Pickett, formerly associate professor of taxonomy and ecology at the State College of Washington, has been made head of the department of botany at that institution to fill the vacancy in the department of botany made by the resignation of Dr. I. D. Cardiff.

Professor Walter Burton Ford has been promoted to a professorship of mathematics in the University of Michigan, and James Garret Van Zwaluwenburg to a professorship of roentgenology.

Mr. Geo. E. Crofoot has been promoted from instructor in mechanical engineering to assistant professor of mechanical engineering in the Towne Scientific School of the University of Pennsylvania.

Mr. E. G. Gaul, M.Sc., lecturer in bacteriological chemistry at the University of Manchester, has been appointed part-time demonstrator in chemistry in the university department. Mr. G. Hickling, D.Sc., has been appointed reader in paleontology and in the absence of Professor Holland, acting director of the geological laboratories.

DISCUSSION AND CORRESPONDENCE

THE MANUFACTURE OF OPTICAL GLASS IN AMERICA

To the Editor of Science: There is an obvious lesson of general interest and of importance in national welfare in the present situation concerning the manufacture of optical glass in this country. That lesson relates in principle to the injury to important manufacturing interests resulting from a large con-

sumer becoming the sole producer of a material vital to that line of manufacture. When expert scientific knowledge is involved it is well that scientific men be alive to the consequences of certain lines of activity.

Four years ago this country imported annually about half a million dollars worth of optical glass, chiefly from Schott in Jena, Mantois in Paris and to some extent from Chance in England. At the outbreak of the war the German supply ceased, while the French and English supplies were limited to that not required for war purposes. Six of the large consumers of optical glass, a government bureau and three glass manufacturers at once started experimental work in this country on the manufacture of optical glass. The entire normal demand for this material is barely sufficient to pay overhead and a modest profit to a single manufacturing concern. But two of these would-be producers have faced the very considerable development expense and brought their production to a factory basis. One of them is a large consumer of optical glass, the other a large manufacturer of plate glass.

The situation faced by the independent consumer is a difficult one. He naturally can not depend upon his largest competitor for his raw material. Neither can the plate-glass manufacturer be depended upon as a permanent source of supply since his large orders for his regular product are much more remunerative. The outlook is therefore rather dismal both for the independent consumer and for the future manufacture of optical glass in America.

Optical glass manufacture, like so many other industries newly taken over in this country, is extremely sensitive to the favor of the capitalist as well as of the scientific expert and skilled laborer. Optical glass has been successfully made in this country in small experimental batches at various times for at least thirty years back, but no one would risk the necessary capital in a business with a demand so circumscribed and a margin of profit so limited. At present a concern devoted exclusively to optical glass, booking the entire American demand might weather the return to normal trade conditions. With the business split into at least two parts, one chief producer a large consumer, another operating it as a trivial side issue, the industry is unlikely to survive.

P. G. NUTTING

PITTSBURGH,
October, 1917

A NOTE ON THE "AGE AND AREA" HYPOTHESIS

PROFESSOR DEVRIES'[1] recent endorsement of the hypothesis advanced by Willis that the range of any plant, barring barriers, depends upon the age of the species, is a most curious illustration of how uncritical a man becomes who is obsessed with a theory. The Willis hypothesis has already been satisfactorily dealt with by Sinnott[2] in the pages of SCIENCE and I wish only to add one or two brief comments.

Neither Willis nor DeVries appear to have any knowledge of or interest in the facts of paleontology, certainly the latter, since he is an evolutionist of a sort, might have selected a name for his supposed factor that had not already been used in a perfectly definite way for a process diametrically the opposite of saltation. This has all been well said by former critics and I mention it in the present connection merely as more cloth off the same piece as the adoption of the Willis hypothesis.

Regarding barriers, we are familiar with certain gross kinds such as mountain ranges and seas, but who can successfully formulate the interrelations of organisms with one another and with their environment and the less obvious but no less real barriers that result from these correlations? One is reminded of Darwin's classic explanation of the relationship between cats and red clover, in which case spinsters might prove an effective barrier to field mice and offer optimum conditions for the spread of clover.

With reference to New Zealand, a philosophic botanist would have to account for very many plant radiations of different ages and from different directions—certainly the

[1] SCIENCE, N. S., Vol. 45, pp. 641–642.

[2] SCIENCE, N. S., Vol. 46, pp. 457–459.

present flora of New Zealand can not legitimately be postulated as having entered that region as a unit at the central point advocated by Willis, nor can the flora of any region as a whole be dated from one period of time or from a single geographical point.

Finally the statement that the dying out of species is a rare event is overwhelmingly opposed by all of the facts of paleontology and by all of the facts of history unless its adherents are prepared to accept the Mosaic cosmogony. This comment is as true of vertebrate and invertebrate paleontology as it is of plants. In the case of the last the probability is very great that the present flora of the globe represents a minute fraction of the extinct floras. Pointing in the same direction is the well-authenticated fact that in all the orders of plants that are prevailingly arborescent the geologic distribution where it is known is found to have been more extensive than the present distribution. The same statement is true of the higher animals and of such invertebrate groups as I am familiar with.

So-called monotypic genera, whether plant or animal, at least in the majority of cases, are relicts of a once wider distribution. Among plants this is strikingly true of arborescent forms and needs qualification only in the case of certain mainly herbaceous, relatively modern and prevailingly temperate groups such as the Papilionaceæ, Labiateæ, Scrophulariaceæ, Plantaginaceæ, Valerianaceæ, etc.

Edward W. Berry
The Johns Hopkins University

SCIENTIFIC BOOKS

A Text-book of Sanitary and Applied Chemistry; or, the Chemistry of Water, Air and Food. By E. H. S. Bailey, Ph.D., Professor of Chemistry, University of Kansas. Fourth Edition revised. New York, The Macmillan Company. 1917. Cloth. 12mo, xxiv + 394 pp. Price $1.60.

As Dr. Bailey says in his preface, the object of the book is to furnish a text, for the use of students, upon chemistry as applied to the most important topics having to do with daily life in the household. The opening chapters deal with the Atmosphere, Fuels, Heating and Ventilation, Lighting, Water, Sewage, Textiles, Soap, Disinfectants and Poisons. The second half of the book treats of the chemistry of food. The treatment is naturally descriptive only and does not cover analytical processes. Throughout the text there are distributed 197 well selected experiments which will greatly help to fix important facts in the student's mind.

W. P. Mason

SPECIAL ARTICLES

THE UFFINGTON SHALE OF WEST VIRGINIA AND ITS SUPPOSED MARINE FAUNA[1]

At a number of localities in northern West Virginia the Uffington shale of I. C. White[1a] lies at the base of the Conemaugh formation, occupying the interval between the Mahoning sandstone above and the Upper Freeport coal of the Allegheny formation below. It is a dark shale, a portion or the whole of which is sandy and bears plant fossils in abundance. It is variable in thickness, forty feet being about the maximum reported, while over much of the area it is lacking altogether, the sandstone being in contact with the coal. The replacement of the shale by the sandstone is clearly the result of erosion as is indicated by the sinuous contact between the two strata, the shale often varying in thickness as much as twenty feet in a distance of a hundred yards.

In 1871, John J. Stevenson, in a paper entitled: "A geological examination of Monongalia county, West Virginia," by John J. Stevenson; together with lists of fossils and descriptions of new species, by F. B. Meek,"[2] described a "dark colored, fine grained, argillaceous" shale overlying the "Upper Freeport" coal and containing abundant invertebrate fossils. Its thickness is given as 12 feet. It is said to be best exposed in the "bluff bordering the bottoms two or three

[1] Published by permission of I. C. White, state geologist of West Virginia.

[1a] I. C. White, West Virginia Geol. Survey, Vol. II., 1903, p. 323.

[2] West Virginia University, Board of Regents, Third Ann. Rept., 1871, for 1870, pp. 41 to 73.

hundred yards above the old 'Point House.'" It is also reported as underlying the "Mahoning" sandstone. Meek's list of fossils includes 7 brachiopoda, 13 pelecypoda, 10 gastropoda, 2 cephalopoda, a trilobite and a crinoid, besides crinoid columns. Three new species of pelecypoda were described; namely, *Nucula anodontoides*, *Yoldia carbonaria* and *Y. stevensoni*. Stevenson informed I. C. White that most of his fossils were collected at the town of Uffington.[3]

White in 1903 described the Uffington shale at Uffington and reported Stevenson's fossils as found in it, thus describing it as bearing both plant and animal remains.[4]

Stevenson in 1906 repeats White's statement that the Uffington shale—which name he now employs for the first time—bears a marine fauna.[5]

Hennen in 1913 mapped the outcrop of the Upper Freeport coal of the area and described the Uffington shale,[6] but did not observe animal fossils in it.[7]

After a close examination of the area the following facts bearing on the location of the marine fossils have come to light, correlation and identification of strata being based on the work of White and Hennen:

At Uffington the Uffington shale is 30 feet thick, plant-bearing throughout and very sandy in the lower half. Above it lie in ascending order the Mahoning sandstone, 39 feet thick, clay-shales 20 feet in thickness, the Brush Creek coal, 6 inches thick, and 3 feet of dark shale of the Brush Creek limestone horizon containing abundant marine fossils. Above the latter is the Buffalo sandstone, 16 feet thick.

At Rock Forge, 4 miles east of Uffington, stands the old "Point House," a frame dwelling, a relic of the settlement built during the operation of the Deckers Creek Iron Works which has been inactive since about 1855. Here the "bluff" referred to by Stevenson is capped by the Buffalo sandstone overlying 13 feet of dark shale containing abundant marine invertebrate fossils, the Brush Creek limestone horizon, which is just above the level of Deckers Creek. The strata at this point dip to the west, and seven tenths of a mile to the northeast the Upper Freeport coal rises to the creek level with the Mahoning sandstone resting directly upon it, no shales intervening between them.

It is thus seen that the dark fossiliferous shale of Stevenson at Rock Forge is Brush Creek. It was found to contain a number of the species listed by Meek.

Stevenson's description of his fossil bed does not agree with the characters of the Uffington shale at Uffington. It is less than one third as thick—the shales do not thin down in the immediate vicinity of the town—no sandy shale is reported and the strikingly abundant plant remains are not noted, nor does another fossiliferous stratum of black shale appear in the section below the well-marked Ames limestone, with which neither of the strata under discussion could have been confounded.[7a] It is therefore concluded that Stevenson collected marine fossils from the Brush Creek and not from the Uffington and it appears that at the time of writing he correlated the coal which lies below the true Uffington with the "Kittanning." This coal he mentions as seen at low water in the Monongahela River between Morgantown and Uffington and is the Upper Freeport of White and Hennen. It is therefore apparent that Stevenson's "Upper Freeport" is a higher coal. From these considerations it seems that there is little doubt that the Brush Creek coal and fossiliferous shale are Stevenson's "Upper Freeport coal" and "Dark shale just below the Mahoning sandstone," respectively. Diligent search by the writer failed to reveal marine fossils in the Uffington shale, while a number of Meek's

[3] I. C. White, oral communication.

[4] W. Va. Geol. Surv., Vol. II., p. 323.

[5] "Carboniferous of the Appalachian Basin," Geol. Soc., America Bull., Vol. 17. 1906, p. 132.

[6] R. V. Hennen, West Virginia Geol. Surv., Report on Monongalia, Marion and Taylor counties, p. 321.

[7] Oral communication.

[7a] A sparse marine fauna is occasionally found in the green and yellow shales of the Pine Creek limestone horizon above the Buffalo sandstone.

listed species were found in the Brush Creek. Besides the writer, Messrs. S. B. Brown, David White, J. W. Beede and R. V. Hennen[8] have examined the Uffington shale at Uffington and vicinity without discovering marine fossils.

Studies of the Conemaugh formation in West Virginia and Maryland by the writer have not revealed a marine fauna at this horizon nor has such been reported by other observers in these and adjoining states, with the exception of the instances mentioned above and two other West Virginia localities reported by Stevenson. These places are: in Wirt county 8 miles north of Burning Springs[9] and at Cutright in Upshur county.[10] These localities have since been studied by members of the West Virginia Geological Survey during the preparation of county reports. From the similarity of the sections given by the different observers[11] the fossiliferous members at these localities also appear to be Brush Creek.

In Ohio the shale is reported by Condit but marine fossils were not found.

The Uffington shale may then be re-defined as follows:

The Uffington shale is a plant-bearing bed of shale, frequently sandy in the lower portion, of non-marine origin, occupying in places the interval between the Upper Freeport coal and the Mahoning sandstone, and indicating by its variable thickness and undulating upper surface that erosion took place over the area of its outcrop before or during the deposition of the Mahoning sandstone. The maximum reported thickness of the shale is 40 feet and, though lacking in many places, its appearance at widely separated points in Maryland, West Virginia and Ohio shows that its former distribution was perhaps general in the Appalachian Carboniferous area.

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[8] Oral communication from S. B. Brown and R. V. Hennen.

[9] Geol. Soc. America Bull., Vol. 17, 1906, p. 149. "Carboniferous of the Appalachian Basin," by J. J. Stevenson.

[10] Idem., p. 135.

[11] R. V. Hennen, W. Va. Geol. Surv., Wirt, Roane and Calhoun counties, Rept., 1911, p. 258; and I. C. White, W. Va. Geol. Surv., Vol. II., 1903, p. 279 (recent field work by D. B. Reger in the preparation of a report on Upshur county confirms the correlation of I. C. White).

BOSTON MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE fifty-fifth meeting of the American Chemical Society was held at the Massachusetts Institute of Technology, Cambridge, Mass., from September 10 to September 13, inclusive. The general program was carried out under the able leadership of Professor Julius Stieglitz, president of the society, and Dr. Charles L. Parsons, secretary, while the local arrangements were under the direction of Professor H. P. Talbot, assisted by the chairmen of the numerous committees. The various divisions were presided over by J. E. Breckenridge, T. J. Bryan, E. H. S. Bailey, L. F. Kebler, L. E. Weber, C. L. Alsberg, J. R. Bailey, H. P. Talbot, and H. E. Howe.

During the session, the usual order of business was carried out, consisting of meetings of the council, with general and public meetings. A strong feature of the meeting was the stress placed upon "War Service of the Chemist." A shore dinner at the Hotel Pemberton, held on Tuesday evening, was much enjoyed and served as a pleasant break in the work before the Society. Wednesday evening was given over to the address by President Stieglitz, who took for his subject, "The Outlook for Chemistry in the United States." This address was printed in the issue of Science for October 5.

During the entire week, the time was taken up by the reading of papers.

DIVISION OF BIOLOGICAL CHEMISTRY

C. L. Alsberg, *Chairman.*

I. K. Phelps, *Vice-Chairman and Secretary.*

Abstracts have been received of the following papers:

Oxidase action in the nucleus: W. J. V. OSTERHOUT. The Indian pipe (*Monotropa uniflora*) contains a colorless chromogen which darkens on oxidation. This process takes place more rapidly in the nucleus than in the cytoplasm, indicating that the nucleus is the center of oxidation in the cell.

The dynamics of the process of death: W. J. V. OSTERHOUT. Determinations of the electrical

conductivity of living tissue enable us to follow the process of death in the same manner as we follow chemical reactions *in vitro*. The process usually proceeds as a monomolecular reaction which is somewhat accelerated or inhibited at the start. It is probable that we have to do with consecutive reactions, in which case the acceleration or inhibition is easily explained. The same assumption enables us to give a quantitative explanation of injury and of recovery.

The dynamics of photosynthesis: W. J. V. OSTERHOUT and A. R. C. HAAS. When plants of *Ulva* are taken from darkness and exposed to light the process of photosynthesis goes on at a regularly increasing speed until a steady rate is reached. This may be explained by assuming that a catalyst is produced in light. The values calculated upon this hypothesis are in good agreement with the observed values.

Note on the physiological action of Cordyceps sinensis: C. L. ALSBERG and J. F. BREWSTER. It is a practise among certain of the Chinese to extract the tufts caused by the growth of *Cordyceps sinensis* on caterpillars and use the extract for medicinal purposes. Extracts made both of the tufts separately and of the tufts with the caterpillars when injected into rabbits proved to be toxic.

The influence of phosphates on the action of alphacrotonic acid on plants: J. J. SKINNER and F. R. REID. Alpha crotonic acid in amounts of 25 and 50 p.p.m. was found to be very harmful to wheat plants grown in nutrient culture solutions. The solutions were composed of calcium acid phosphate, sodium nitrate and potassium sulphate and were prepared according to the triangular system. Growth was reduced about 50 per cent. when the material was used in amounts of 50 p.p.m. In cultures containing 80 p.p.m. P_2O_5 growth was reduced 30 per cent., in cultures containing 40 p.p.m. P_2O_5 growth was reduced 45 per cent., and in cultures with no P_2O_5 growth was reduced 55 per cent. When the material was used in the cultures in amounts of 25 p.p.m. growth was reduced about 30 per cent. In cultures having 80 p.p.m. P_2O_5, growth was reduced 9 per cent., and in those having 40 p.p.m. P_2O_5, 28 per cent., and where no P_2O_5 was present 34 per cent. Phosphate seemed to have an ameliorating effect on the harmlessness of the crotonic acid. NaH_2PO_4 used in the place of $CaH_4(PO_4)_2$ in the culture solutions had a similar effect on the action of the crotonic acid. Experiments using Na_2HPO_4 and also Na_3PO_4, showed that each of these phosphate salts, regardless of the character of the base, in combination had an action antagonistic to the harmfulness of alphacrotonic acid.

The oxidation of vanillin to vanillic acid by certain soil bacteria: WILLIAM J. ROBBINS and ELBERT C. LATHROP. A bacterium, apparently specific for vanillin, has been isolated from an Alabama soil. This organism when grown in a medium of inorganic salts with vanillin as the sole source of carbon, in the course of five days completely oxidized vanillin to compounds of a nonphenolic character. The first oxidation product has been isolated and its identity as vanillic acid has been established by the mixed melting points, the crystalline form and solubilities, the color reactions, the neutralization equivalent, methoxyl determination and organic combustion. By means of color reactions the rate of oxidation of vanillin to vanillic acid and the rate of the ensuing oxidation of vanillic acid has been determined. Vanillin has been found in a number of field soils and the infertility of some of these soils may be due to vanillin. Vanillic acid has also been shown to be harmful to growing plants. The biological oxidation of these harmful soil compounds and the effect of fertilizer compounds on this biological transformation is therefore of special interest in soil fertility.

The value of yeast "vitamine" as a supplement to a rice diet: A. D. EMMETT and L. H. MCKIM, Research Department of Parke, Davis & Co., Detroit. The criteria for estimating the value of the diet of polished rice supplemented with vitamine for polyneuritic pigeons was to determine the rate of full recovery of pigeons that had been brought out of the typical polyneuritis attack by a treatment of the Seidell yeast vitamine. This was indicated by the body weight curves before and after treatment. The control vitamine-containing diet for the treated birds was natural unpolished rice. Other feeds were also used—corn, barley and oats. It was found that this yeast vitamine preparation was a most excellent agent for bringing about recovery from the typical attack of polyneuritis; that, as a supplement to polished rice, when used in rational amounts (equal to slightly more than the dose needed for treatment) the diet was adequate for producing moderate gains in weight, but that these gains were much less than those obtained with the control or unpolished rice diet. Corn produced smaller gains than unpolished rice

but more than polished rice. Barley produced fair gains for a time but later the pigeons lost weight. Oats proved to be very inferior. The results suggest that this vitamine preparation, when used in amounts commensurate with rational therapy, is a very valuable adjuvant to a vitamine-poor diet but in order to obtain the very best results one should have for the patient a dietary containing foods rich in vitamine.

The growth promoting value of the lactalbumins obtained after separating casein by (a) *hydrochloric acid and* (b) *lactic acid culture:* A. D. Emmett and M. E. Slater, Research Department of Parke, Davis & Co., Detroit. The lactalbumins used were obtained from skim milk whey. In one case, the casein was removed from the skim milk by a slight acidification with hydrochloric acid and in the other it was thrown out by using a lactic acid "starter" and allowing the milk to incubate until sufficient acid was formed to cause the separation. The two lactalbumins were compared as to their growth promoting value by feeding young rats that had been kept on a maintenance ration. It was found, on a low protein plane, that the lactic acid culture lactalbumin had very little growth producing value when compared with the hydrochloric acid lactalbumin. The influence of various factors involved was studied among them —varying the quantity of lactalbumin, adding cystine and increasing the total protein intake.

The influence of accessory substances on growth, with a low protein ration containing lactalbumin from lactic acid whey: A. D. Emmett and M. E. Slater, Research Laboratory of Parke, Davis & Co., Detroit. Young rats which had been on maintenance were put upon a basal ration low in protein but ample in energy and mineral content. The protein concentrate used was corn gluten. This was supplemented with lactic acid, lactalbumin. Butter fat was omitted. Vitamine preparations (water soluble) were added to the basal relation after a test period showed that the expected rate of growth did not take place. In fact, during this test period, there was almost no response to the change in the ration from maintenance to basal. Upon replacing part of the lard with butter fat, there was a slight increase in growth; adding vitamine preparation B to the basal ration, there was some effect produced; and on adding vitamine preparation A, a decided gain in weight resulted which compared favorably with the growth curve obtained on using the hydrochloric acid lactalbumin.

On the origin of the humin formed by the acid hydrolysis of proteins III. Hydrolysis in the presence of aldehydes II. Hydrolysis in the presence of formaldehyde: Ross Aiken Gortner and George E. Holm. Hydrolysis in the presence of formaldehyde completely alters the nitrogen distribution obtained by Van Slyke's method. Black insoluble humin is formed from tryptophane and no other known amino acid is concerned in the reaction. The primary reaction of black humin formation involves only the indole nucleus and not the α amino group of the aliphatic side chain of tryptophane. Formaldehyde forms a soluble humin with tyrosine which is precipitated by $Ca(OH)_2$. Hydrolysis in the presence of formaldehyde causes enormous increases in the ammonia fraction but the increase is not due to ammonia but to volatile alkaline compounds. The detailed paper will appear in the *Jour. Amer. Chem. Soc.*

On the relative imbibition of glutens from strong and weak flours: Ross Aiken Gortner and Everett H. Doherty. The gluten was washed from both "strong" and "weak" flours and the hydration capacity of the colloids measured by immersing weighed disks in different concentrations of certain acids, allowing them to remain a definite length of time and again weighing. Lactic and acetic acids produced greatest imbibition, the form of these hydration curves being very different from those of hydrochloric and oxalic acids which produced much less hydration. The gluten from a "weak" flour has a much lower *rate of hydration* and a much lower *maximum hydration capacity* than has the gluten from a "strong" flour. Gluten from a "weak" flour changes from a gel to a sol at a much lower degree of hydration than does that from a "strong" flour. There is an inherent difference in the colloidal properties of the glutens from "strong" and "weak" flours and these glutens would not be identical even if the flours had originally had the same salt and acid content. The paper will be published in *Jour. Agr. Res.*

The nitrogen distribution in protalbinic and lysalbinic acids: Ross Aiken Gortner and Cornelia Kennedy. Lysalbinic and protalbinic acids were prepared from egg albumen by Paal's method and their nitrogen distribution, together with that of the original egg albumen, determined by Van Slyke's method. No marked difference was observed in any of the fractions although both of the derived products show a somewhat greater apparent lysine content. This is probably due to

ornithine derived from arginine. The analyses furnish no evidence as to whether or not these "acids" are true chemical compounds or as to whether or not their structure is more simple than is that of egg albumen. The paper will appear in the *Jour. Amer. Chem. Soc.*

The effect of prolonged acid hydrolysis on the nitrogen distribution of fibrin with especial reference to the ammonia fraction: Ross Aiken Gortner and George E. Holm. Fibrin was boiled with 20 per cent. HCl for varying periods of time ranging from 1 hour to 6 weeks, the ammonia fraction increases continuously showing a 150 per cent. increase at the end of six weeks over that obtained at the end of twelve hours. This increase in ammonia comes almost entirely from the deamination of mono amino acids. The ammonia fraction of a twenty-four or forty-eight-hour hydrolysate can not be taken as an absolute measure of amide nitrogen for some "deamination" nitrogen is undoubtedly present, the amount depending both upon the particular protein and the length of hydrolysis. The paper will appear in the *Jour. Amer. Chem. Soc.*

Comparative analyses of fibrin from different animals: Ross Aiken Gortner and Alexander J. Wuertz. Fibrin has been prepared from the blood of cattle, sheep and swine and the nitrogen distribution determined by Van Slyke's method. No differences significantly greater than the expected experimental errors were found. It would thus appear that fibrin from any of these three sources can be used interchangeably in experimental work without invalidating the results. Whether or not this is true for fibrins from other sources remains still an open question. The paper will appear in the *Jour. Amer. Chem. Soc.*

The nitrogen distribution of fibrin hydrolyzed in the presence of ferric chloride: Clarence Austin Morrow. When a protein is hydrolyzed in the presence of ferric chloride an accurate nitrogen distribution can not be obtained. There is a substantial increase in the ammonia N, due probably to deamination of amino acids at the higher temperature of hydrolysis. The acid soluble humin increases at the expense of a corresponding loss from the "filtrate from the bases," thus indicating that the earlier conclusion regarding the soluble humin N of soils was incorrect and that this fraction of a soil hydrolysis may be of protein origin. Since hydrolysis in the presence of either carbohydrates or ferric chloride radically changes the nitrogen distribution of proteins, it is obvious that no accurate knowledge of *soil proteins* can be obtained by applying Van Slyke's method to soils.

A new form of ultra-filter; its uses in synthetic and biological chemistry: P. A. Kober. A new form of ultra-filter is described which depends on pervaporating both dialysis and diffusate solution during dialysis. Its usefulness in filtering off humus and other coloring matter in biological work and organic synthetic work, as well as colloids in general, is pointed out. The apparatus makes it possible now, for the first time, to dialyze quantitatively.

Studies on Piper bredemeyeri, an adulterant of matico: A. Viehoever and M. G. Mastin. A study has been made of the volatile oil obtained from *Piper bredemeyeri*, an adulterant of matico, *Piper angustifolium*. It was found that the volatile oil did not yield asaron, which is obtained from genuine matico, nor matico camphor, obtained from *Piper angustifolium* var. *ossanum*. The oil from *Piper bredemeyeri*, containing over 50 per cent. of dillapiol, was very similar in composition to that reported to be obtained from *Piper mandoni*. The chemical and botanical similarities suggest that the name *Piper mandoni* has been given to plants belonging to the species *Piper bredemeyeri*. A paper on the subject is in preparation.

Studies on mustards and mustard substitutes: A. Viehoever, C. O. Ewing and J. F. Clevenger. Work on monographs of mustards and mustard substitutes has progressed considerably. New supplies from India, China and Japan have been identified on the basis of studies including the botany and chemistry of the seeds, and also studies of plants grown from the seeds. Material of Indian brown mustard proved to be substituted by Indian rape or tori, *Brassica napus* var. *dichotoma*. Chinese mustard, *Brassica juncea*, was found to be usually improperly collected, containing a considerable amount of immature seeds and weed seeds, including generally *Eruca*. A preliminary study of the volatile oils obtained from Chinese mustard, *Brassica juncea*, and Japanese mustard, *Brassica cernua*, indicates that they are mixtures containing only in part allylisothiocyanate. The volatile oil from *Brassica campestris sativa chinensis*, another adulterant of mustard, proved to be crotonylisothiocyanate. This oil has no mustard qualities. Since the plant grows very vigorously, plans are under way to utilize it either for greens and salads or for stock

feed. The seeds yield over 40 per cent. of a fatty oil with the general characteristics of rape oil.

An alkaloid from lupinus leucopsis: O. F. Black. The European lupines have been very extensively studied especially in respect to their alkaloids. No work has been reported on the native species of the plant which grow abundantly on western ranges. *Lupinus leucopsis,* suspected of causing the poisoning of cattle, was tested for alkaloids and gave positive reactions. The alkaloid was thereupon isolated in the following manner: the seeds were finely ground and extracted by macerating at room temperature with 80 per cent., alcohol slightly acidified with HCl. The alcohol was driven off by boiling in vacuo and the residual solution quantitatively precipitated with Mayer's reagent. The precipitate washed and decomposed with H_2S, filtered, and the filtrate extracted with chloroform which removed the alkaloid as the hydriodede. On evaporating the solvent the salt remained as lemon yellow needle crystals, mpt. 246°. It could be recrystallized from water or alcohol. The alkaloid, prepared by treating the salt with silver oxide, was colorless and amorphous and resisted attempts to crystallize it. A preliminary analysis indicated that the formula was probably $C_{15}H_{32}N_2O_2HI$, which does not correspond with the formula of any alkaloid hitherto isolated from lupines. Also the common European varieties when subjected to the same treatment failed to yield any body of a similar nature. It, therefore, seems reasonable to conclude that it is a new alkaloid. It is intended to continue work on it when more material can be procured.

On the histology and chemistry of secretory and nectary glands of the cotton plant: A. Viehoever and E. E. Stanford. The occurrence, distribution, and histology of secretory as well as nectary glands has been established. Microphotographs have been prepared which show clearly the structure and lysigenetic character of the secretory glands. The chemistry of these glands is under investigation, and while not yet completed, very interesting results have been obtained. The glands located in parts not exposed to light, especially in seeds and roots, contain gossypol, while those of insolated parts, namely, stems, leaves, bolls and flowers, contain querimeritrin and anthocyans. Other genera belonging together with *Gossypium* to Hibisceae have been studied in regard to the presence of secretory glands. While some of the genera did not show them, others, especially *Thurberia* (wild cotton) showed these glands very conspicuously and very similarly arranged as in the case of cotton plants.

Studies on edible and poisonous beans of the Lima type (Phaseolus lunatus): A. Viehoever, C. O. Ewing and M. G. Mastin. Work on cyanogenesis consisted of the investigation of poisonous and edible beans of the Lima type, *Phaseolus lunatus.* Examination of a considerable number of domestic Lima beans disclosed the fact that they all yield hydrocyanic acid under certain conditions, the amount of which, however, does not exceed 10 mg. per 100 gm. of beans. Foreign beans of the same type, imported from the Orient or South America, were found to contain in certain instances a considerably higher amount. As a result of these findings a large number of shipments of such beans, especially Rangoon or Burma beans, were excluded from import. The glucoside, yielding hydrocyanic acid, has been isolated and its characteristics determined. This facilitated the working out of a satisfactory reliable method for obtaining the maximum available amount of hydrocyanic acid from the beans. It also assisted in experiments concerning the removal of the glucoside from the bean.

Oxalic acid in foods and spices: A. Viehoever, W. F. Kunke, and M. G. Mastin. A large number of common foods and spices have been examined for the presence of oxalic acid and its salts. In some instances this has been supplemented by quantitative determinations, namely: Rhubarb stalks, contained 0.39 per cent. of oxalic acid and rhubarb leaves contained 0.84 per cent., in the form of soluble oxalates and insoluble calcium oxalate. These amounts were found in fresh material obtained on the market. In the dried root of rhubarb, used as a drug, the amount of oxalic acid was 10.77 per cent., being present in the form of calcium oxalate. No soluble oxalates were found. The amount found in spinach was 0.82 per cent., and that in sweet potatoes 0.10 per cent. In beets, 0.17 per cent., and in dried figs 0.21 per cent. Dasheen contained 0.49 per cent., and the common bean (*Phaseolus vulgaris*) 0.4 per cent. Acheen pepper, containing usually a varying amount of more or less undeveloped fruit, showed 1.61 per cent. oxalic acid in the solid, almost developed fruits, and 3.39 per cent. in the fruits which were more or less empty. The amount of oxalic acid found in ground pepper can possibly be used to detect the presence of added pepper shells.

(*To be continued*)